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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/061,455	02/04/2002	Nicholas Ayache	017346-0173	8100
22428	7590	03/27/2006	EXAMINER	
FOLEY AND LARDNER LLP SUITE 500 3000 K STREET NW WASHINGTON, DC 20007			STEVENS, THOMAS H	
			ART UNIT	PAPER NUMBER
			2123	

DATE MAILED: 03/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/061,455

Applicant(s)

AYACHE ET AL.

Examiner

Thomas H. Stevens

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 07 November 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 November 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

1. Claims 1-14 were examined.

***Section I: New Examiner***

***New Examiner***

2. Tom Stevens is presiding over the prosecution in place of William Thomson.

***Section II: Non-Final Rejection (2<sup>nd</sup> Action)***

***Drawings***

3. Figures 1-3D should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures.

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. The term "desired" in claim 13 is a relative term which renders the claim indefinite.

***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Delingette "Toward Realistic Soft-Tissue Modeling in Medical Simulation" (1997). Delingette discloses surveying existing models of deformation in medical simulations.

Claim 1. An apparatus for simulating the deformation of materials (abstract: 3<sup>rd</sup> paragraph), particularly of soft body tissues (title), comprising: a memory configured to store (part of a computer: abstract, 2<sup>nd</sup> paragraph), for at least one object having a three-dimensional shape (pg. 512, left column, introduction): mechanical parameters of the material of the object (pg. 516, right column, 1<sup>st</sup> paragraph) data as to the position of the object recorded at the vertices (pg.516, left column, "Tissue Cutting and Suturing" section, 3rd paragraph)of the at lest one selected mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph) , and force data which represents, in intensity and position, stress to be exerted on the object, and a computer operatively connected to the memory(part of a computer: abstract, 2<sup>nd</sup> paragraph) to evaluate new position (pg.515, right column, 3rd paragraph)s of the vertices, as a function of the stress exerted and the mechanical parameters of the material, wherein the computer comprises: a first module (encompassing the entire simulation process:

pg.519, right column, 2nd paragraph, lines 7-11) (12, 14, 16, 18, 20) configured to determine repeatedly, for each mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph), the deviation between the current length of an edge of the mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph) of the mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph) and its previous length and/or its length at rest (pg. 519, left column, 4th paragraph), and to store respective force data relating to a potential energy of deformation for each vertex (pg. 518, "Finite Element Models" section, 2nd paragraph) of the mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph), the respective force data being obtained from said deviation, and a second module (encompassing the entire simulation process: pg. 519, right column, 2nd paragraph, lines 7-11) (30, 32, 36) configured to determine repeatedly, for each vertex (pg. 518, "Finite Element Models" section, 2nd paragraph), new data as to the position of the vertex (pg. 518, "Finite Element Models" section, 2nd paragraph) as a function of the composition of the forces exerted thereon data relating to at least one previous position of the vertex (pg. 518, "Finite Element Models" section, 2nd paragraph) and mechanical parameters of the material.

Claim 2. An apparatus according to claim 1, wherein for an object in the form of a hollow three-dimensional envelop the grid pattern chosen is triangular (pg. 518, right column, "Finite Element Models" section, 1st paragraph), and wherein the computer is configured to determine the composition of forces at each vertex (pg. 518, "Finite

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Element Models" section, 2nd paragraph) of a triangle (pg.518, right column, "Finite Element Models" section, 1st paragraph), as a function of the deviation between the current length of each of the triangle and the length of the side at rest (pg.519, left column, 4th paragraph).

Claim 3. An apparatus according to claim 1, wherein for an object of solid three-dimensional shape (pg. 512, left column, introduction), the grid pattern chosen is tetrahedral (pg.518, right column, "Finite Element Models" section, 1st paragraph), wherein the computer is configured to estimate the composition of the forces at each vertex (pg. 518, "Finite Element Models" section, 2nd paragraph) of the tetrahedron, as a function of the deviation between the current length of each of the tetrahedron and the length of this edge at rest (pg.519, left column, 4th paragraph).

Claim 4. An apparatus according to claim 1, wherein the computer is configured to determine differences between the squares of the current length and the preceding length and/or the length at rest (pg.519, left column, 4th paragraph) of each edge in order to determine said composition of forces.

Claim 5. An apparatus according to claim 1, wherein the memory is configured to store, in association with each mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph) , mechanical parameters of the material of the mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph) ,

at least partially defined locally, particularly at the level of the mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph) or elements thereof.

Claim 6. An apparatus according to claim 5, wherein the computer is configured to determine said deviation between the current and at rest (pg.519, left column, 4th paragraph) lengths, in order to estimate a derivative (pg. 519, left column, 2<sup>nd</sup> paragraph, last sentence) of the potential deformation energy of each mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph) with respect to the position of each vertex (pg. 518, "Finite Element Models" section, 2nd paragraph) of the mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph) , the potential energy of deformation being expressed as a function of Green-St. Venant tensor (pg. 519, left column, 2<sup>nd</sup> paragraph, last sentence and 4<sup>th</sup> paragraph) and of mechanical coefficients inherent in the material in said mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph) , which provides said force data for the vertex (pg. 518, "Finite Element Models" section, 2nd paragraph) of the mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph) .

Claim 7. An apparatus according to claim 1, wherein the mechanical parameters comprise the Lamé coefficients (pg. 519, left column, 4<sup>th</sup> paragraph) of the material in each in question.

Claim 8. An apparatus according to claim 1, further comprising a third module (encompassing the entire simulation process: pg.519, right column, 2nd paragraph, lines 7-11) for developing a data structure and configured to delete mesh (pg. 514, right column, "Interaction with Rigid or Soft Bodies" section 2nd paragraph) sides or edges which connect two "virtual" vertices (pg. 518, "Visualization" section, 4<sup>th</sup> line with pg. 512, left column, "Introduction" section).

Claim 9. An apparatus according to claim 8, wherein the third module (encompassing the entire simulation process: pg.519, right column, 2nd paragraph, lines 7-11) for developing the data structure is further configured to verify that the grid pattern (pg. 519, left column, 3<sup>rd</sup> paragraph) satisfies predefined properties of conformity.

Claim 10. An apparatus according to claim 1, wherein the second module (encompassing the entire simulation process: pg.519, right column, 2nd paragraph, lines 7-11) configured to determine the new position (pg.515, right column, 3rd paragraph)al data of the vertices (pg.516, left column, "Tissue Cutting and Suturing" section, 3rd paragraph) as a function of the composition of forces at each vertex (pg. 518, "Finite Element Models" section, 2nd paragraph), is configured to determine said



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new positional (pg.515, right column, 3rd paragraph) data as a function of time which makes it possible to follow the evolution of the respective positions of the vertices (pg.516, left column, "Tissue Cutting and Suturing" section, 3rd paragraph) over time.

Claim 11. An apparatus according to claim 10, wherein the determination of the new position (pg.515, right column, 3rd paragraph)al data of the vertices (pg.516, left column, "Tissue Cutting and Suturing" section, 3rd paragraph)uses a model for solving a differential equation to each vertex (pg. 518, "Finite Element Models" section, 2nd paragraph).

Claim 12. An apparatus according to one of the preceding claims, wherein the computer is capable of repeatedly determining the positional data of the vertices (pg.516, left column, "Tissue Cutting and Suturing" section, 3rd paragraph) of the grid, in order to determine the evolution of said positions over time.

Claim 13. An apparatus according to claim 12, further comprising: a display interface (pg. 516, left column, 5th paragraph "user interface") capable of representing the object in a predetermined form and shown with the desired tensor (pg. 519, left column, 2<sup>nd</sup> paragraph, last sentence) grid pattern, and wherein the display interface (pg. 516, left column, 5th paragraph "user interface") is operatively connected to the computer in order to display the shape of the moving object.

Claim 14. An apparatus according to claim 1, further comprising a user interface (pg. 516, left column, 5th paragraph "user interface") provided with a handling device for simulating one or more forces exerted globally (pg. 517, right column, "Topological Design" section, 1<sup>st</sup> paragraph) on the object.

***Section III: Response to Applicants' Arguments (1<sup>st</sup> Non-Final Rejection)***

***Amendments to the Abstract/Specification/Drawings***

8. Applicants are thanked for addressing these issues. The Office acknowledges and withdraws objections regarding the abstract and the specification; however, Examiner Thomson's issue regarding annotating figures 1-3D, as prior art is still outstanding. Unless the applicants can prove inventorship towards these figures the objection stands; but the other outstanding drawing issues are withdrawn.

***112 2<sup>nd</sup>***

9. Applicants are thanked for addressing these issues. The 112 2<sup>nd</sup> issues are acknowledged and withdrawn (based on the first office action).

***101***

10. Applicants are thanked for addressing these issues. Rejection is withdrawn.

***102(b)/103(a)***

Applicants' arguments, see 10-13, filed 07 November 2005, with respect to the rejections of claims 1-5, 8-14; 6-7 under 102(b) and 103(a), respectively, have been

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fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground of rejection is made in view of Delingette.

### ***Citation to Relevant Prior Art***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- Debunne et al., "Interactive Multiresolution Animation of Deformable Models" 1999 Eurographics Workshop pg.1-7: teaches an animated elastic deformable material at interactive rates.
- Montagnat et al., "Volumetric Medical Images Segmentation using Shape Constrained Deformable Models" 1997. pg.1-10: teaches solving a problem of extracting geometric models from low contrast volumetric images.

### ***Correspondence Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mr. Tom Stevens whose telephone number is 571-272-3715, Monday-Friday (8:00 am- 4:30 pm EST).

If attempts to reach the examiner by telephone are unsuccessful, please contact examiner's supervisor Mr. Paul Rodriguez 571-272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.


Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status

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information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Answers to questions regarding access to the Private PAIR system, contact the Electronic Business Center (EBC) (toll-free (866-217-9197)).

March 17, 2006

TS

  
Paul L. Rodriguez 3/20/06  
Syman Primary Examiner  
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